A Detailed Look at Science Targets Within the Eberswalde Landing Ellipse

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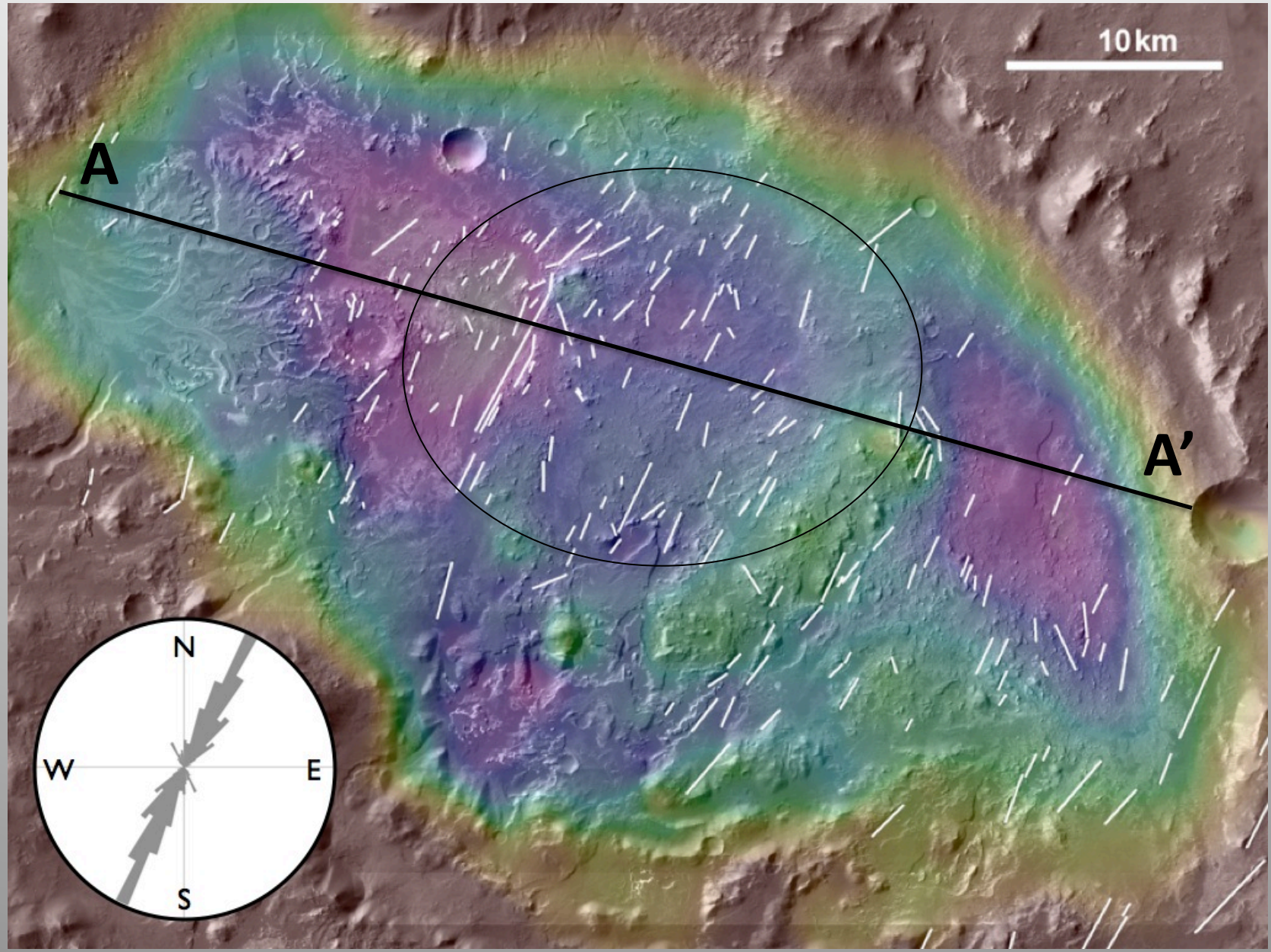
Eberswalde has “the delta”…
… and what else?

- Structural lineaments interpreted as faults
- Ancient basin floor materials:
  1. Possible Holden ejecta
  2. Possible Eberswalde basement
- Six fluvio-deltaic systems
- Isolated mesas and hills of layered rock
- Fractures and vein-like ridges
- Inverted channels

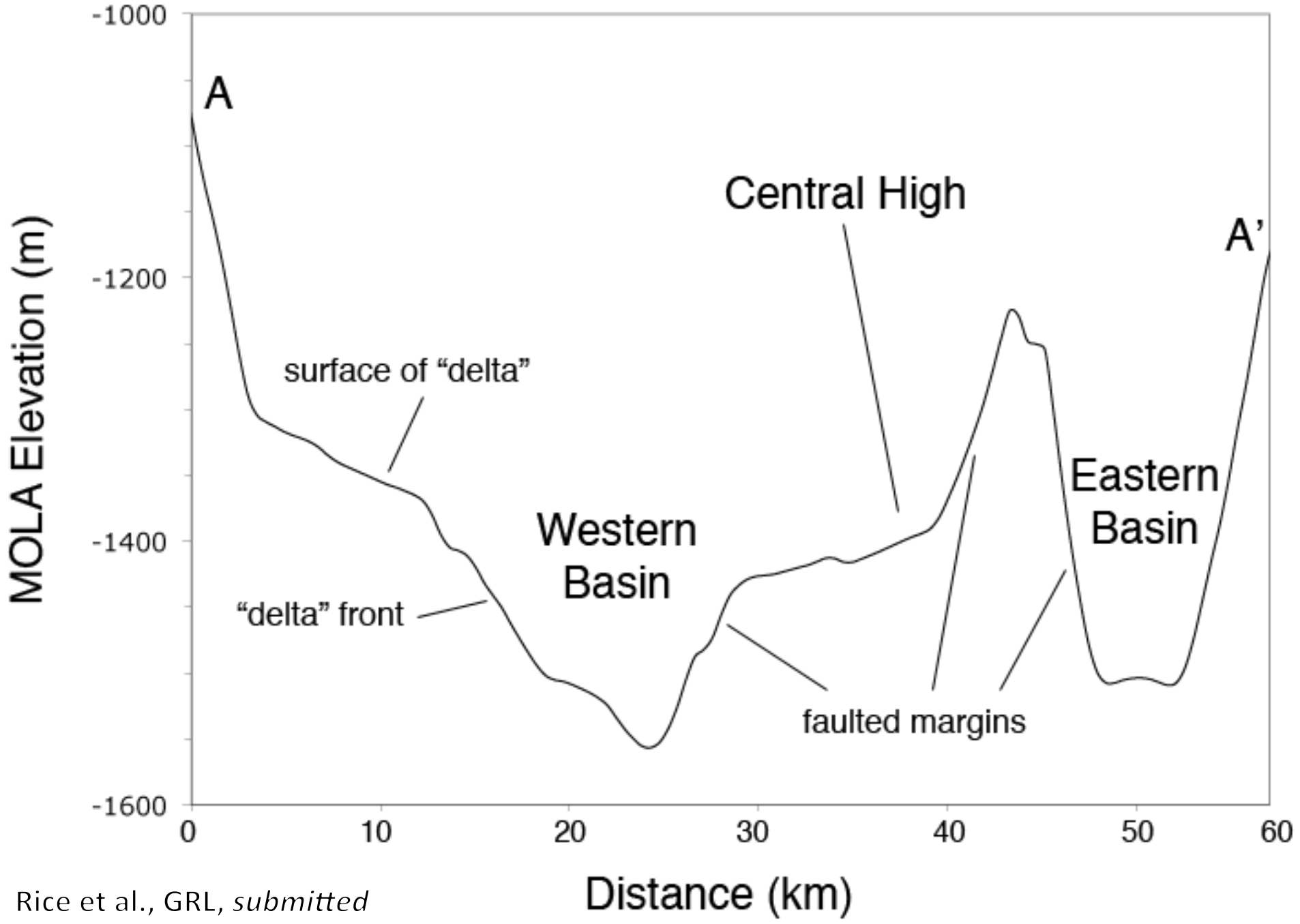
→ ***Morphologic diversity in the landing ellipse***

MOLA topography and putative faults



Rice et al., GRL, *submitted*

Max elev. -1000 m Min elev. -1600 m

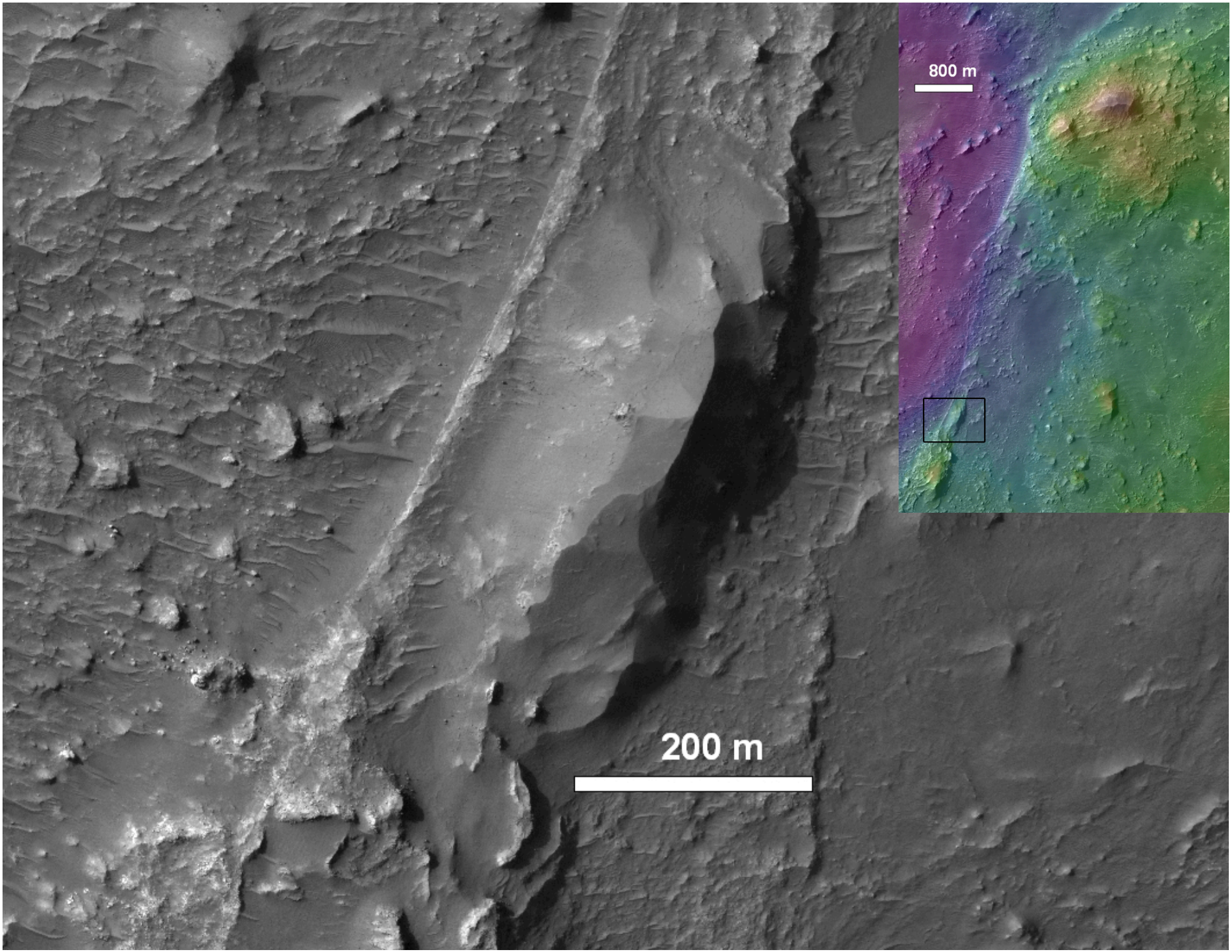


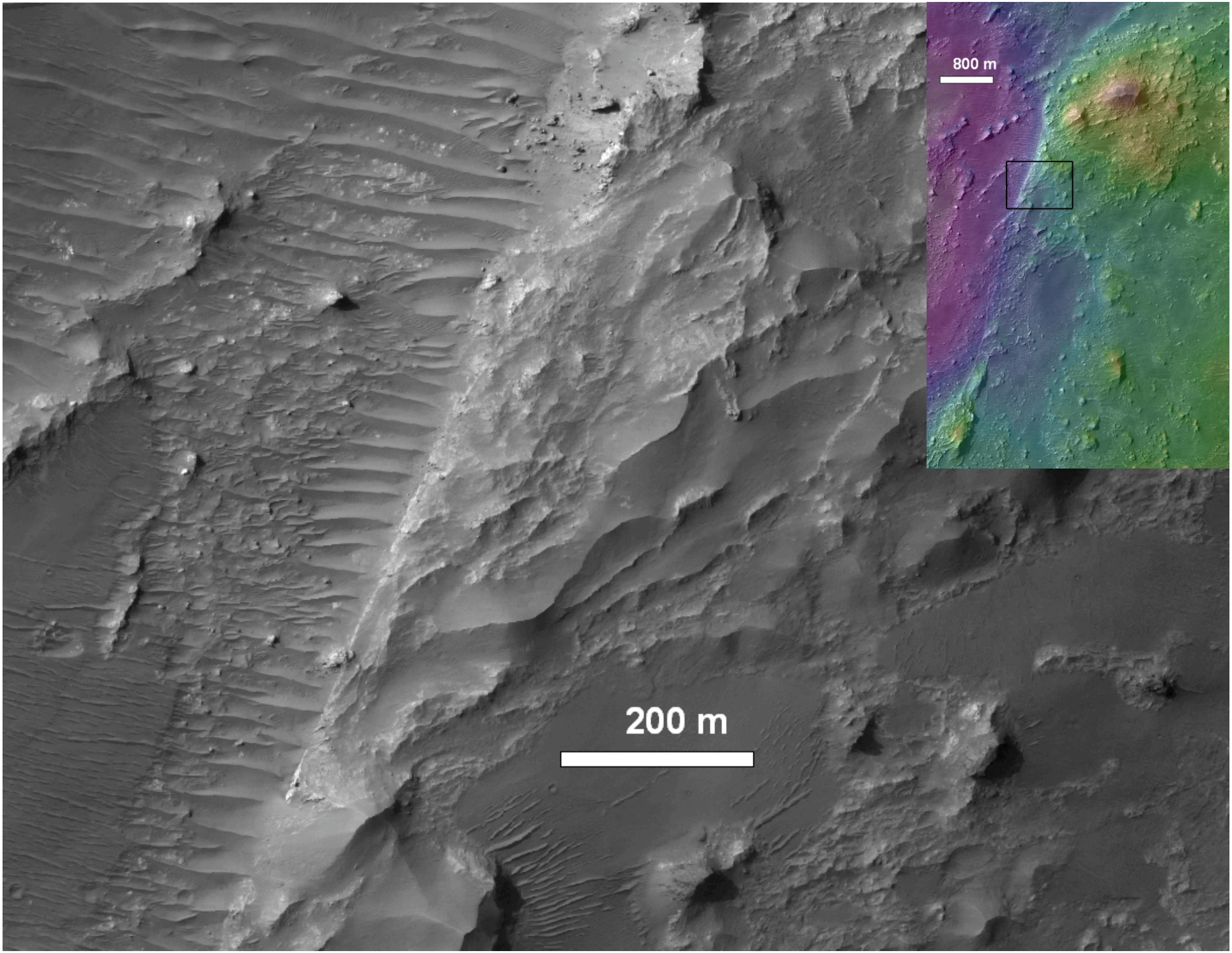
Rice et al., GRL, *submitted*

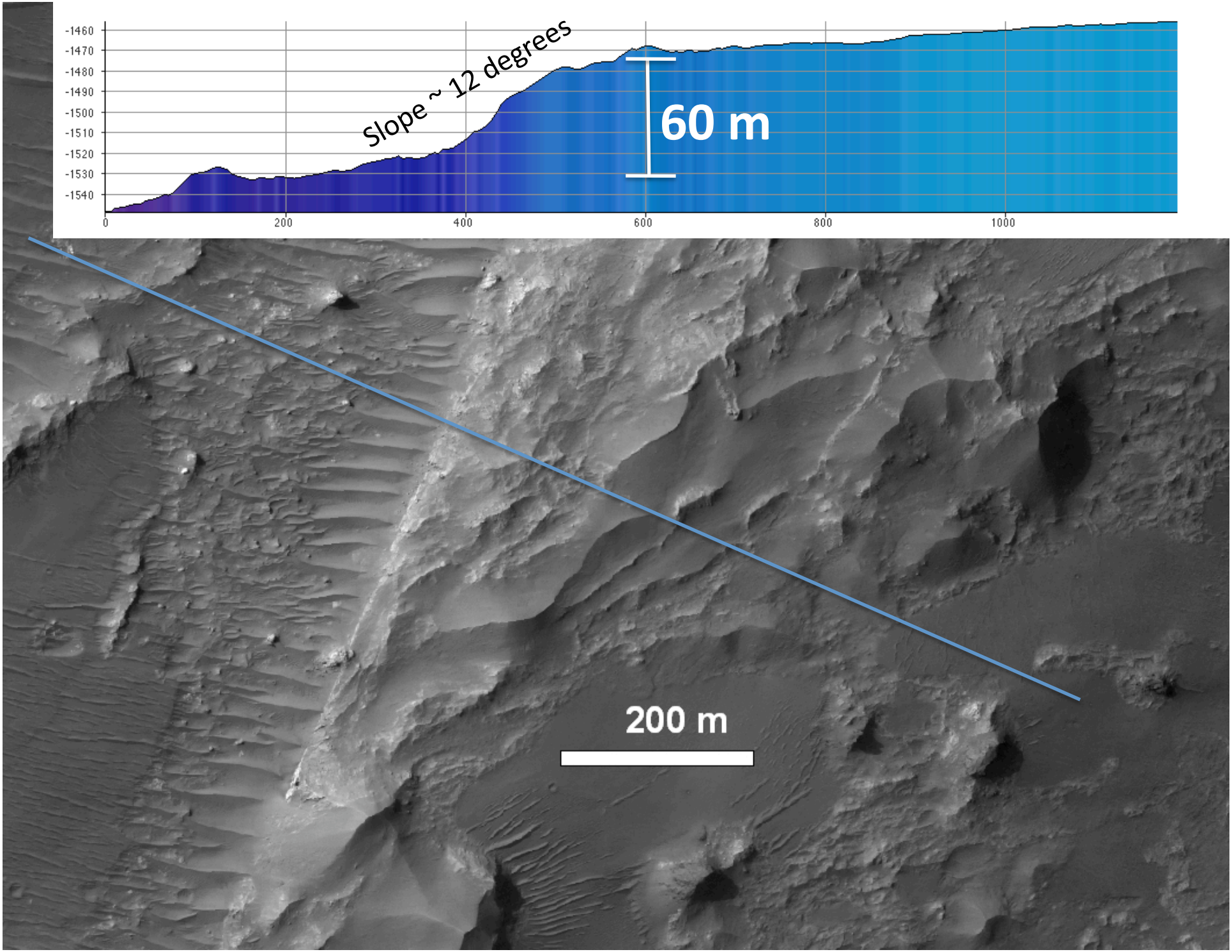
detail of fault topography

Max elev. -1200 m

Min elev. -1600 m


800 m
200 m


800 m
200 m

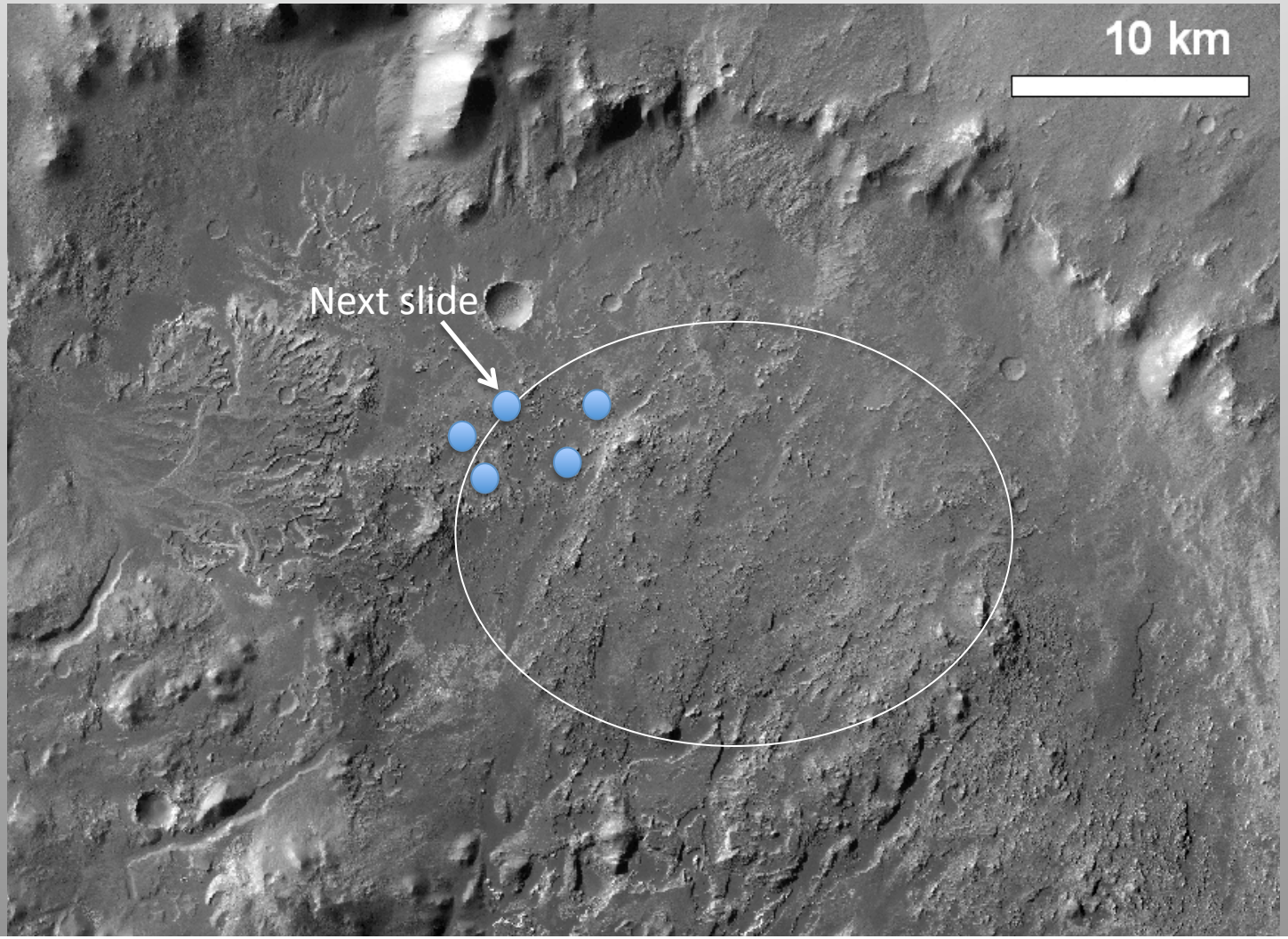

-1460
-1470
-1480
-1490
-1500
-1510
-1520
-1530
-1540
0
200
400
600
800
1000
Slope ~ 12 degrees
60 m
200 m

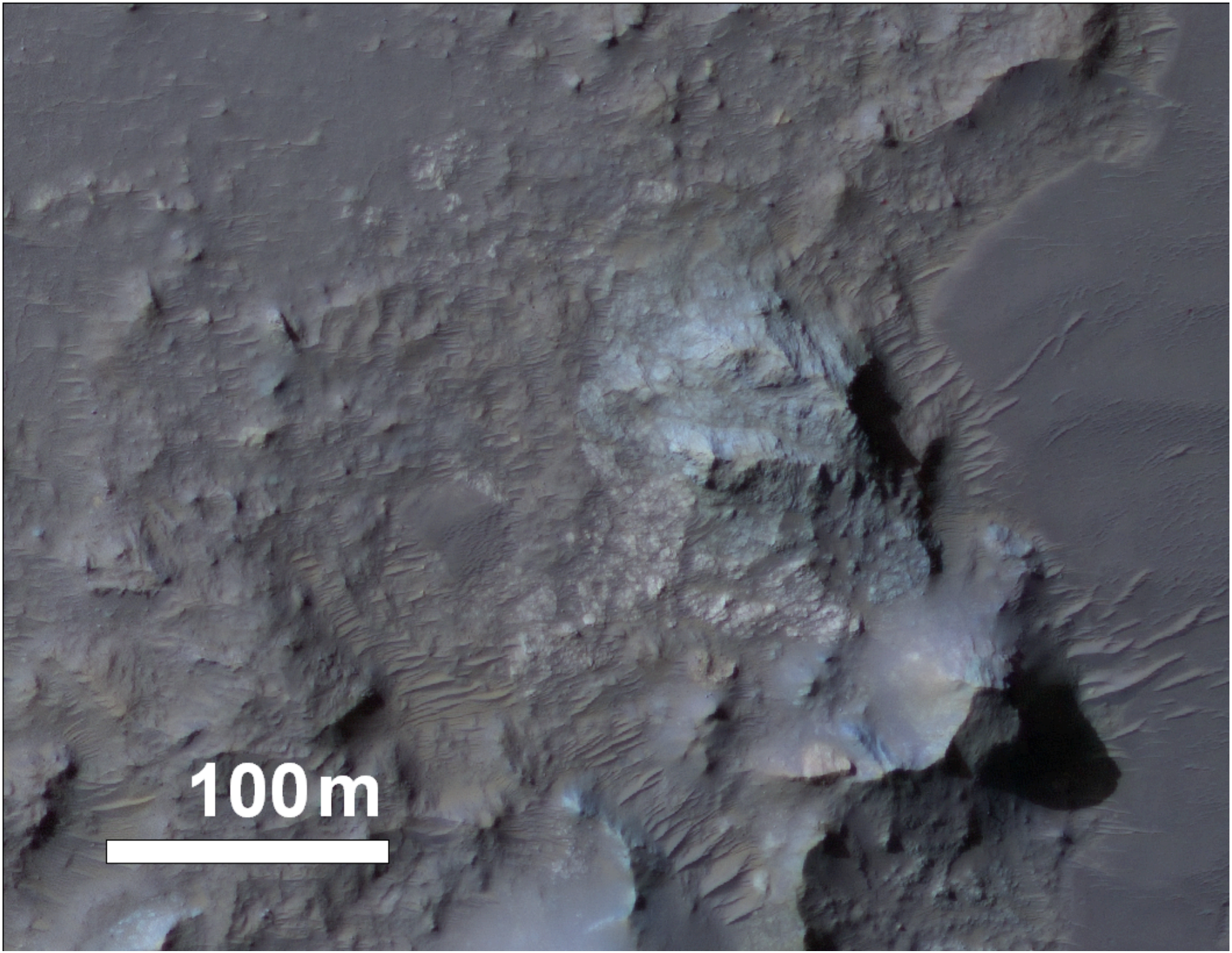
Eberswalde Unit Map

Rice et al., in prep, to be submitted to *Mars*

Basin Floor Materials

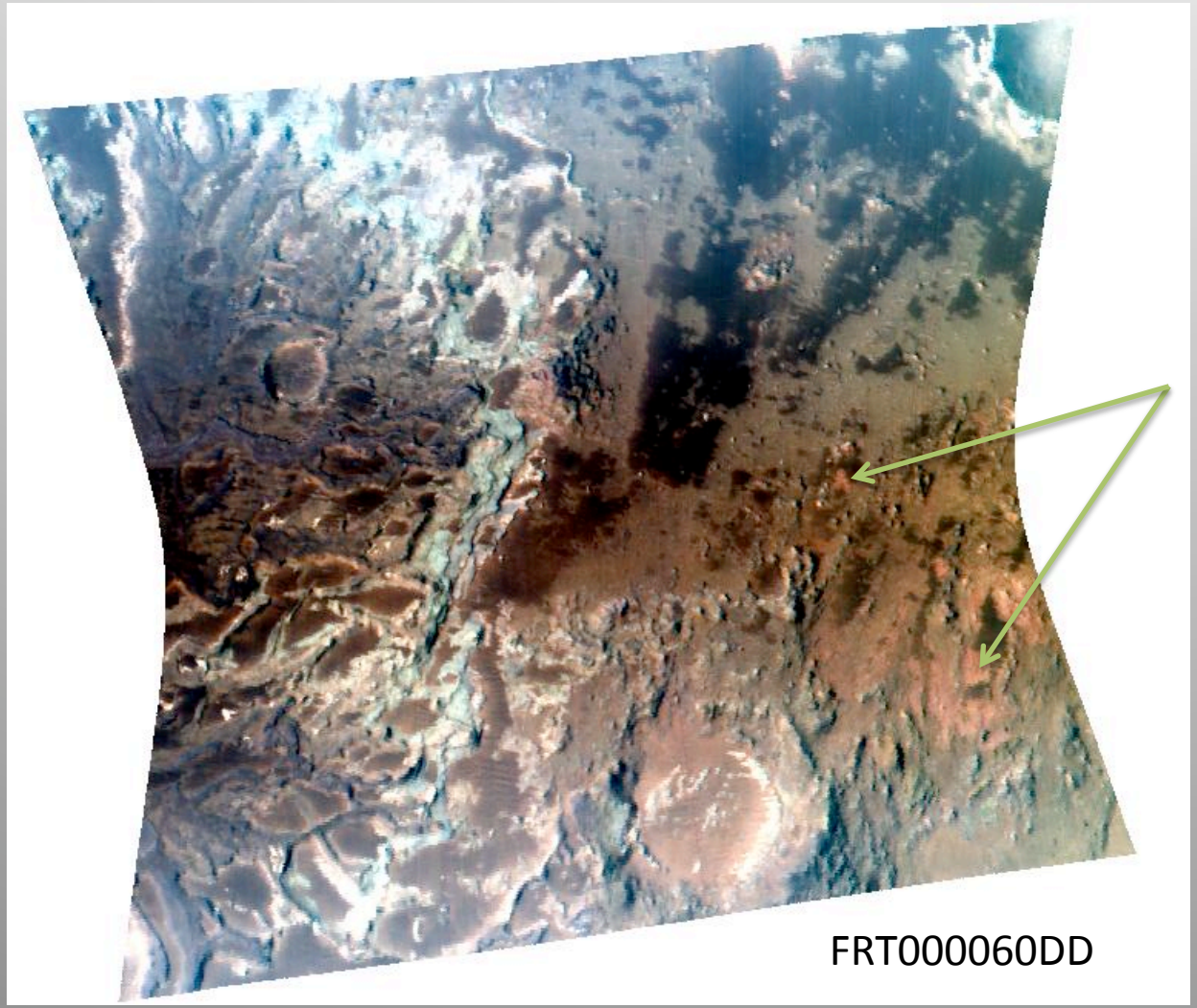
1. Olivine-bearing unit (possible ancient crater bedrock)




100 m

Basin Floor Materials

1. Olivine-bearing unit (possible ancient crater bedrock)

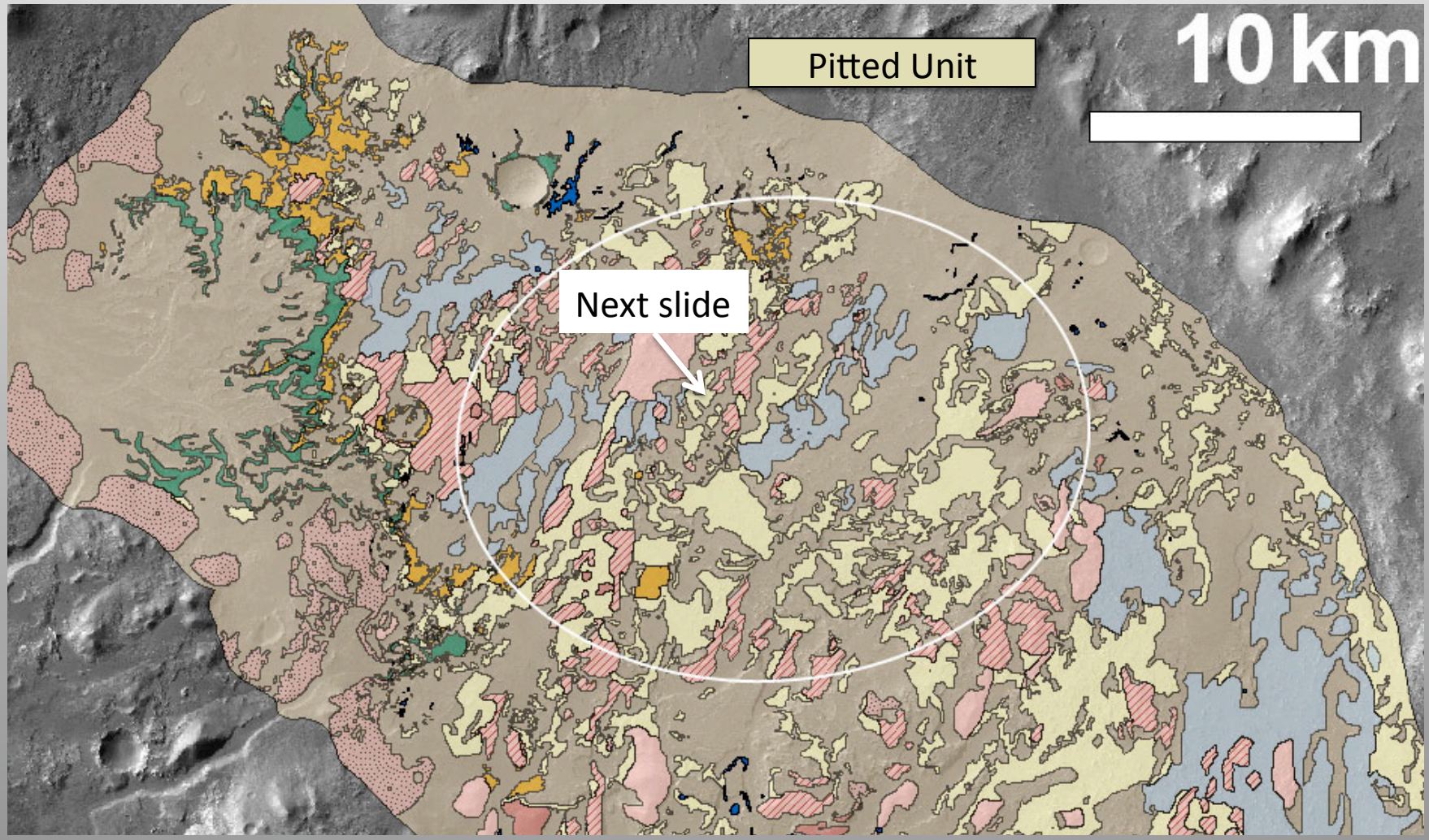


Olivine-bearing material on Eberswalde crater floor

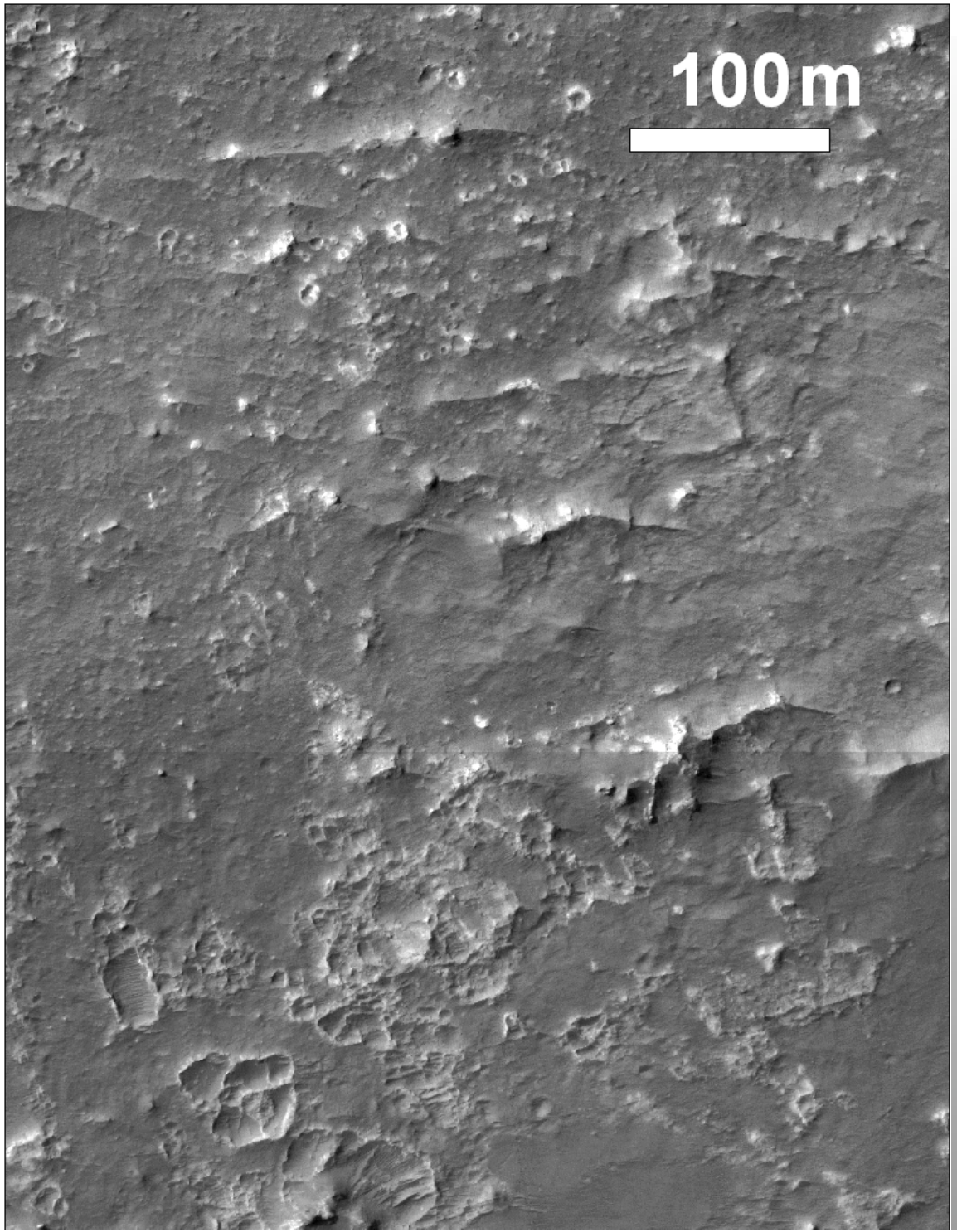
- Blueish-white in HiRISE false-color images
- Red in CRISM false-color images
- Nancy McKeown will show CRISM spectra
- Outcrops in the deepest portion of the Western Basin
- Possibly the crystalline Eberswalde bedrock

Basin Floor Materials

2. Pitted unit (possible Holden ejecta)



Rice et al., in prep, to be submitted to *Mars*



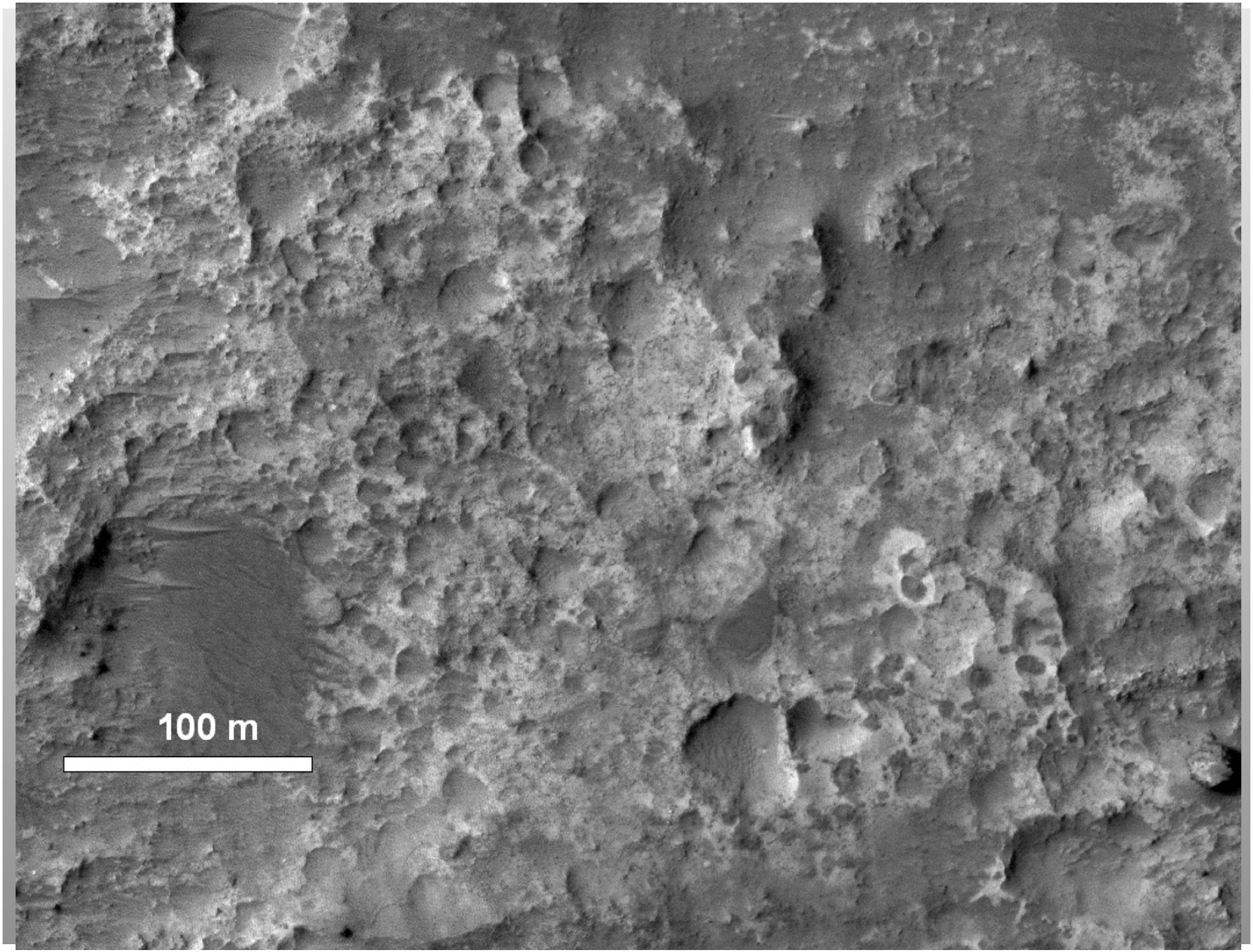
HYPOTHESES:

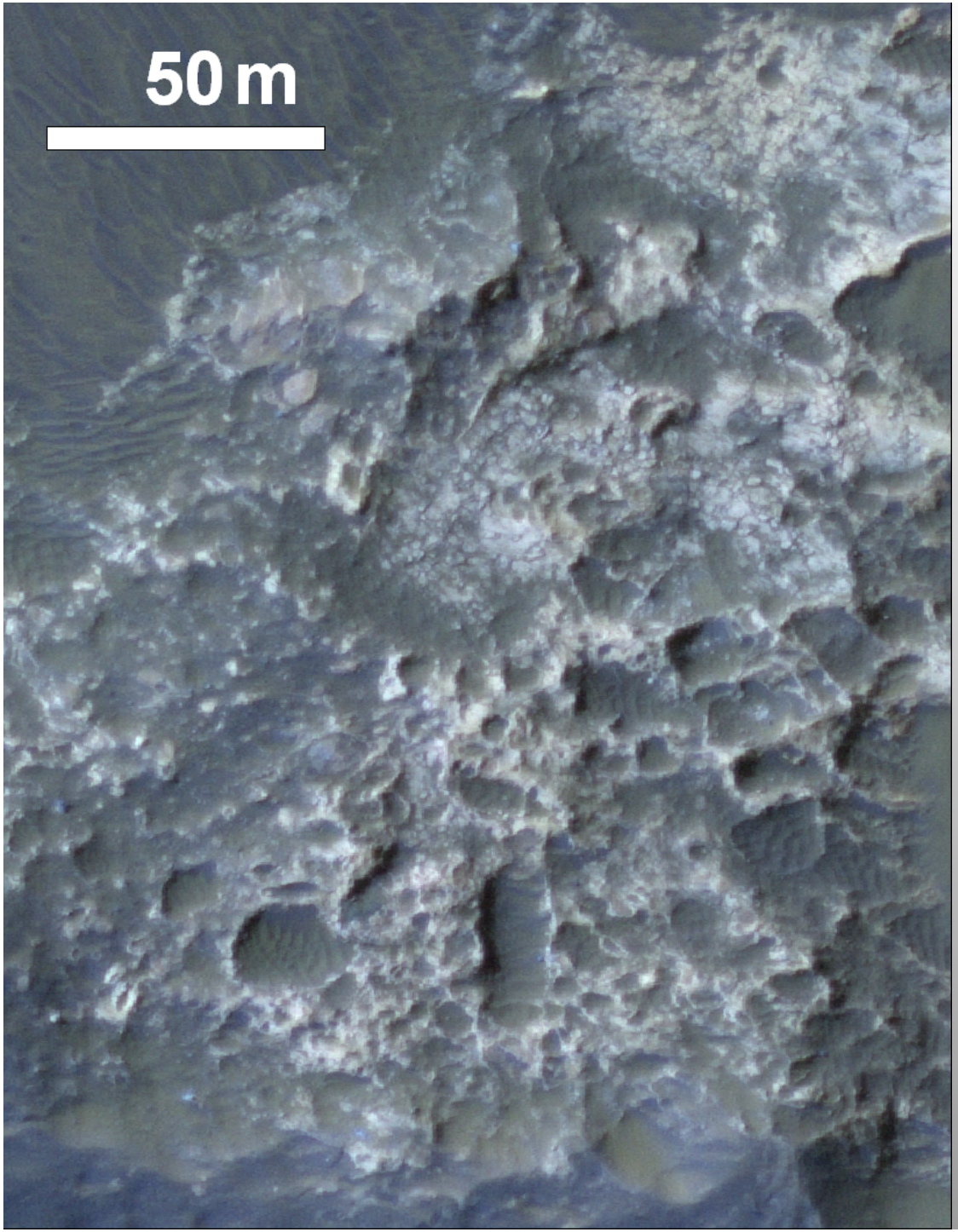
(1) the pits result from heterogeneous erosion of an ancient surface saturated with small impact craters;

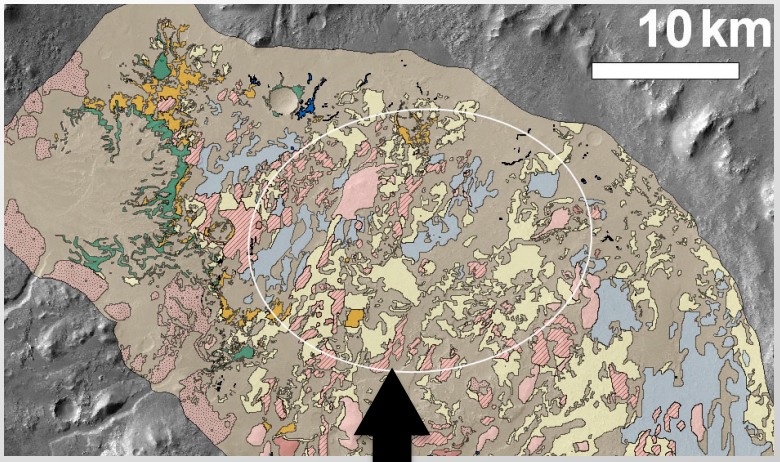
(2) the pits formed from de-volatilization and degradation of an ancient, basal impact melt surface;

(3) the light-toned material may be the erosionally resistant matrix of a megabreccia (possibly from the Holden impact event [*Grant et al.*, 2008])

Exposures in the center of the landing ellipse are spectrally featureless in CRISM data

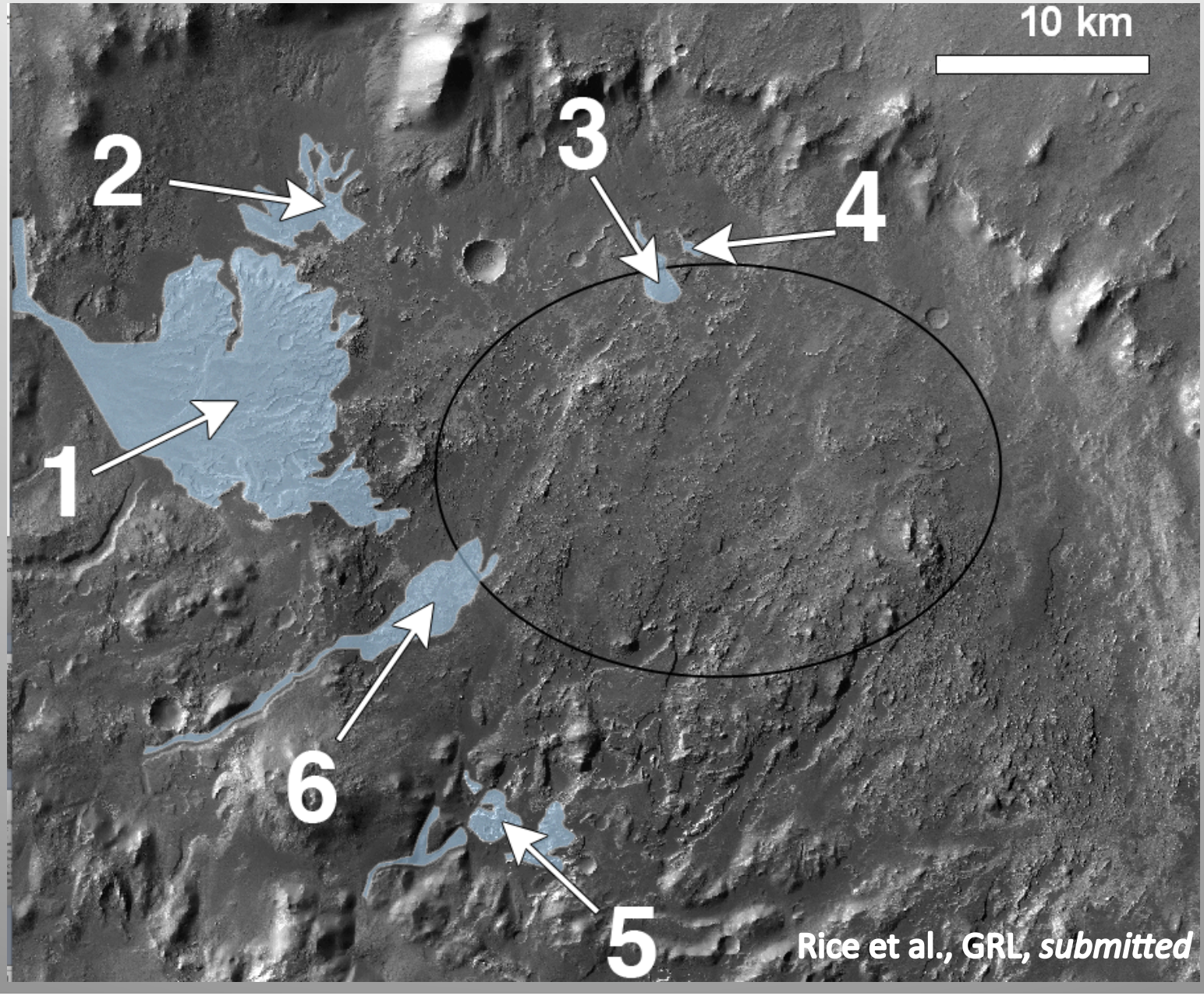

100 m

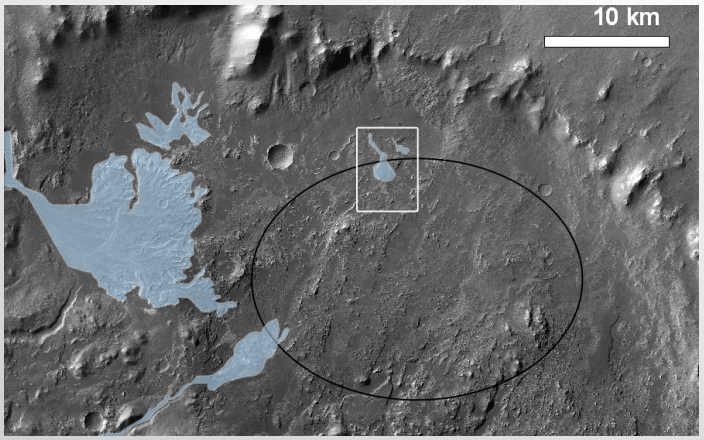




McKeown et al. (2011) will show that exposures of the pitted unit in southern Eberswalde have 2.3 um and hydration bands in CRISM spectras

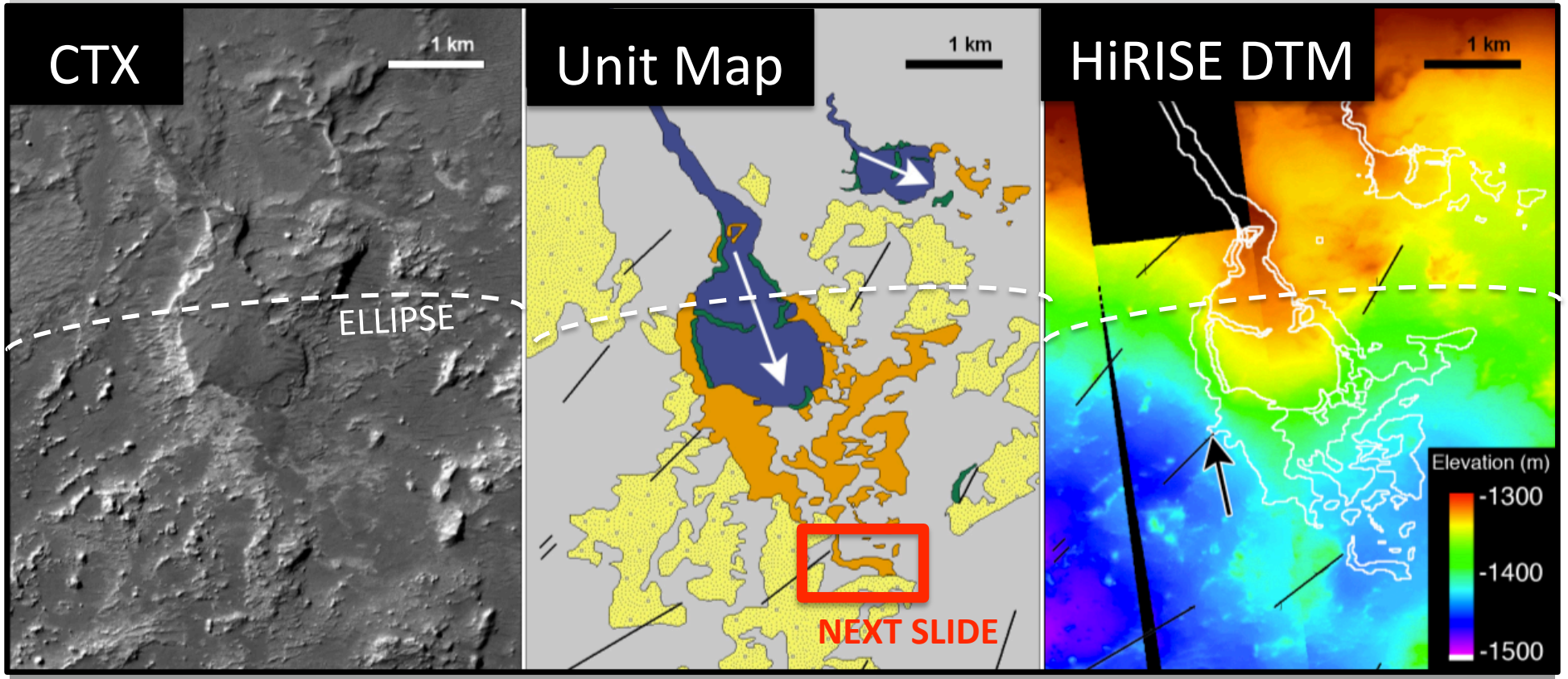
Fluvio-deltaic system map





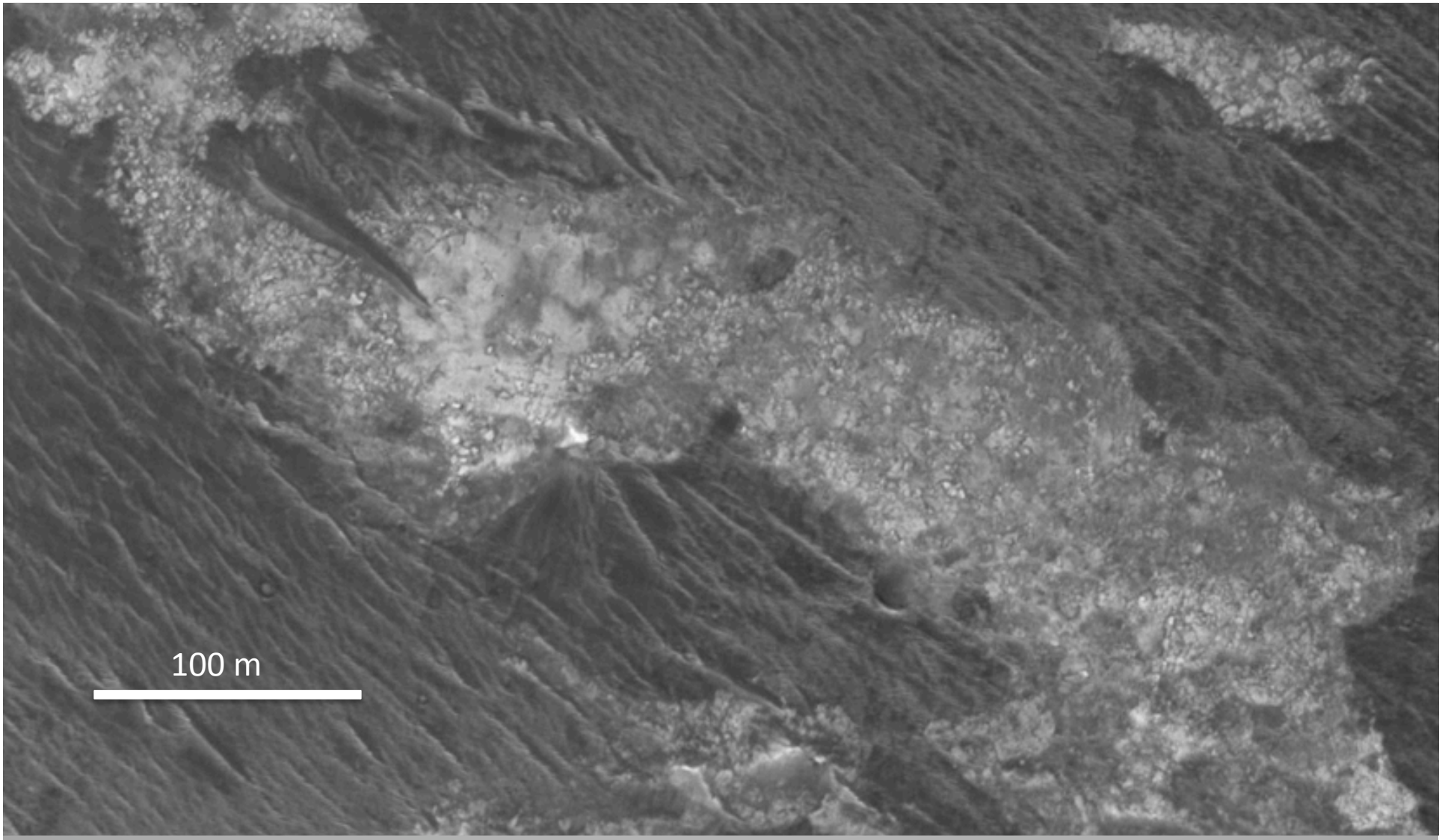
Fluvio-deltaic systems 3 and 4

- Fluvio-deltaic system extends 2 km within the landing ellipse
- Front of putative delta at -1385 m, on the central topographic high
- Sediments overlay possible faults in the pitted unit

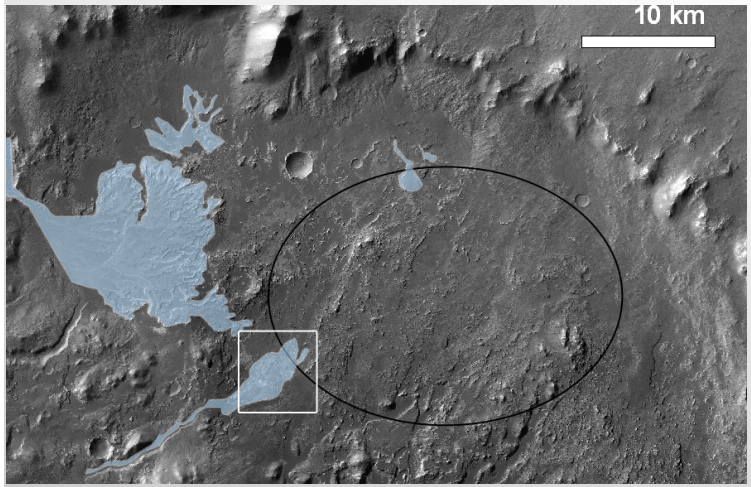


Rice et al., GRL, *submitted*

Mantled Lobe Surface
Layered Unit
Subpolygonally Fractured Unit
Pitted Unit
Basin Floor Unit
Possible Faults

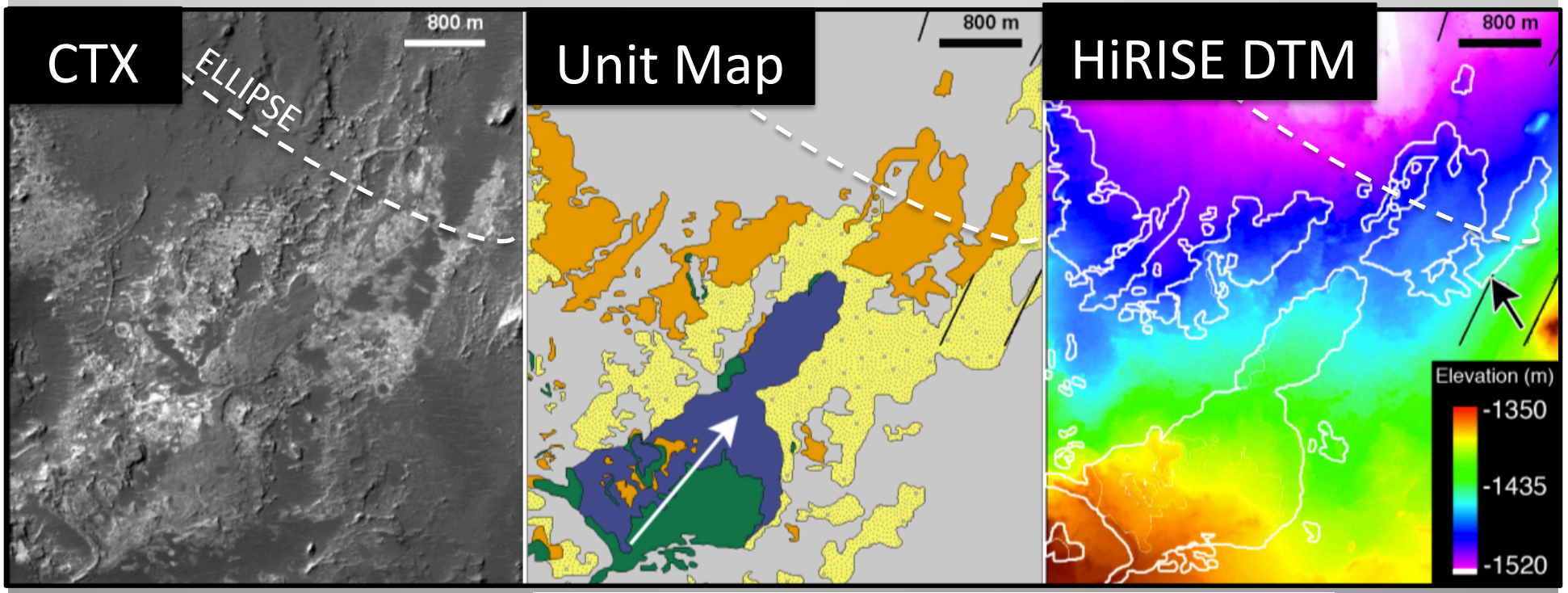


- Extensive exposures of light-toned, subpolygonally fractured material in the landing ellipse
- Clearly associated with a fluvio-deltaic system
- McKeown et al. (2011) will show this outcrop may contain phyllosilicates



Fluvio-deltaic systems 6

- Fluvio-deltaic system extends ~ 1 km within the landing ellipse
- Front of putative delta at -1450 m, in the deep Western Basin
- Sediments overlay possible faults in the pitted unit

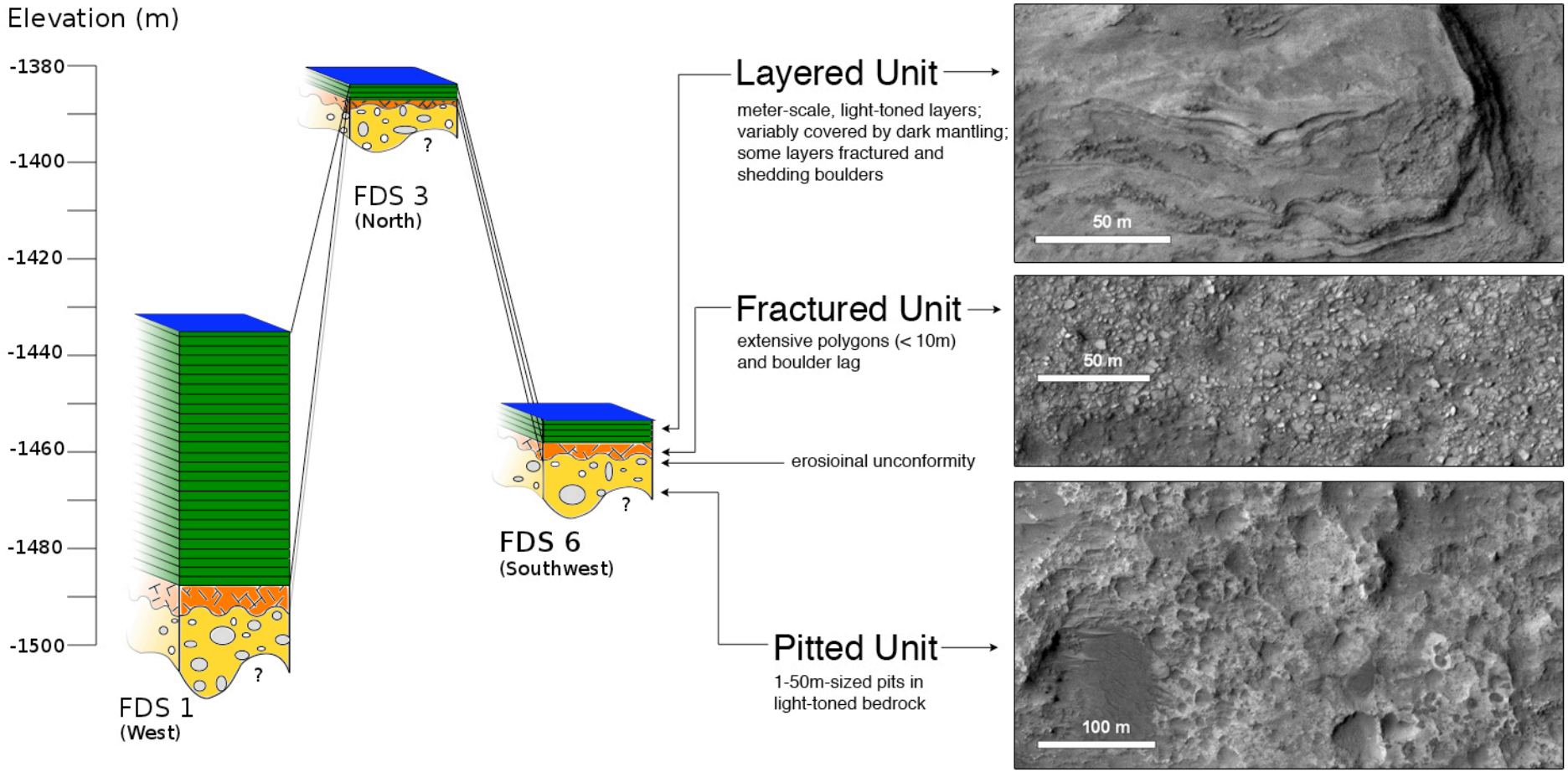


Rice et al., GRL, *submitted*

Fluvio-deltaic systems

Consistent stratigraphy at all six systems, observed at varying elevations

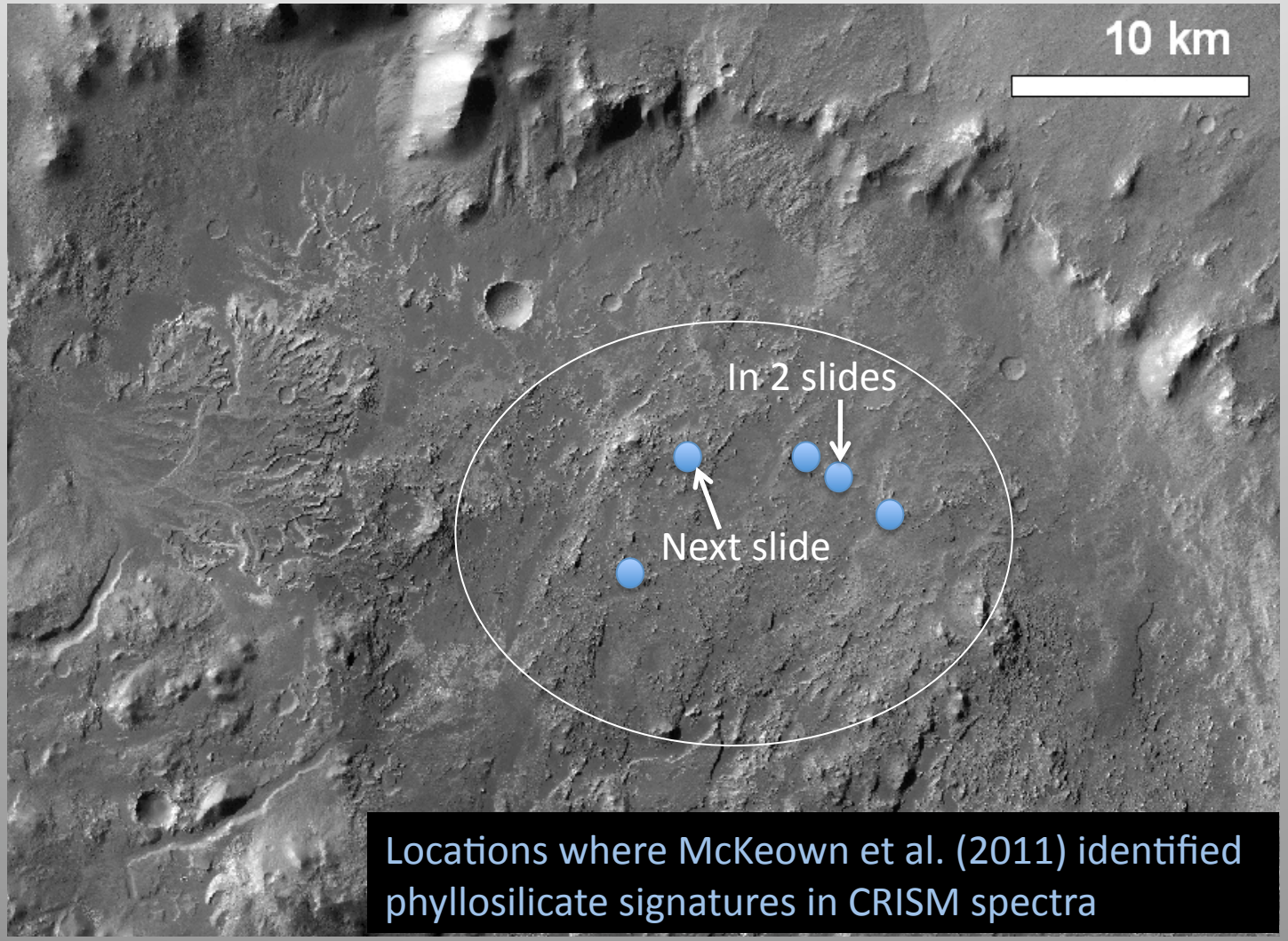
- the large-scale topography of Eberswalde was in place before fluvio-deltaic activity



Rice et al., GRL, *submitted*

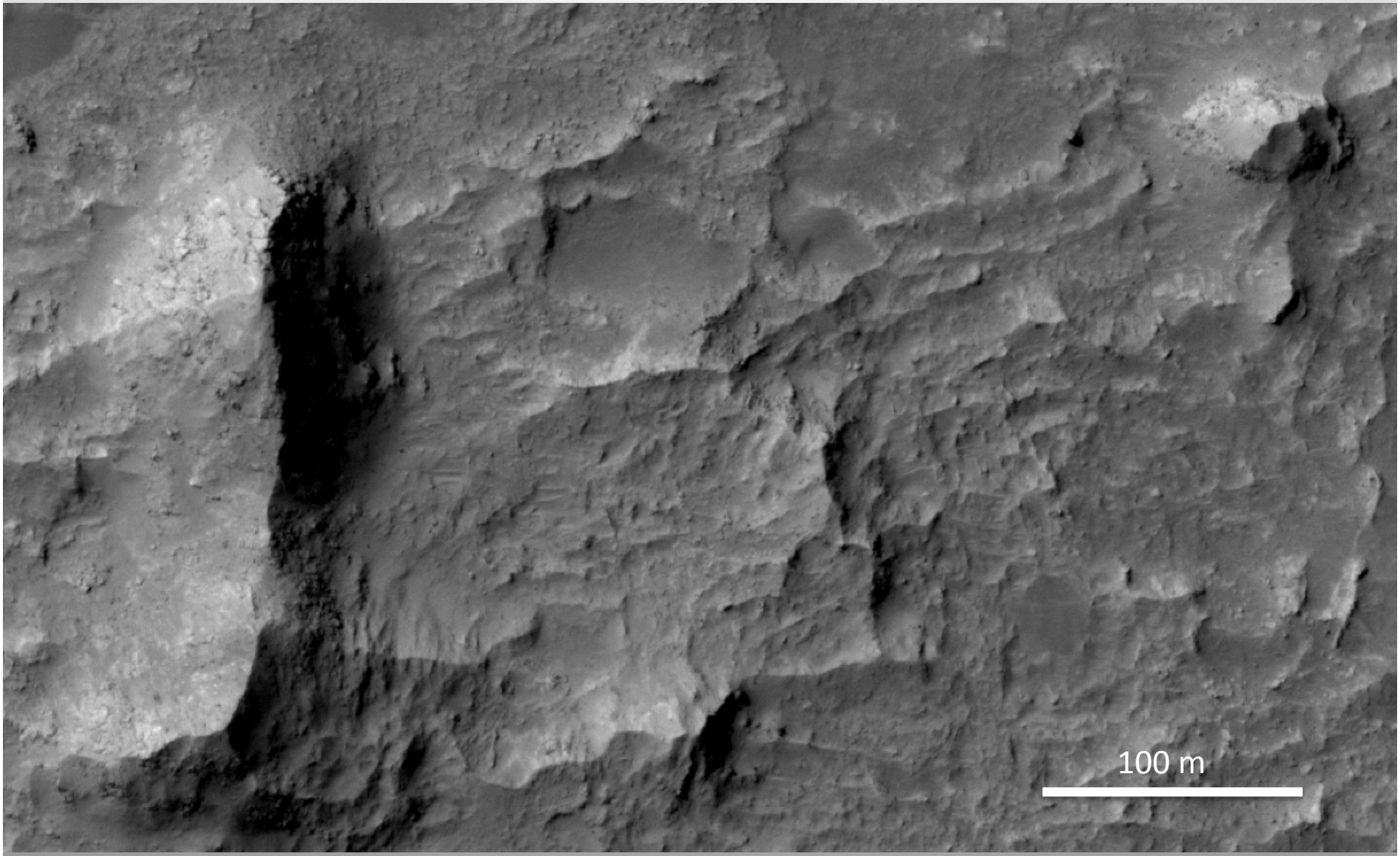
Isolated mesas and hills

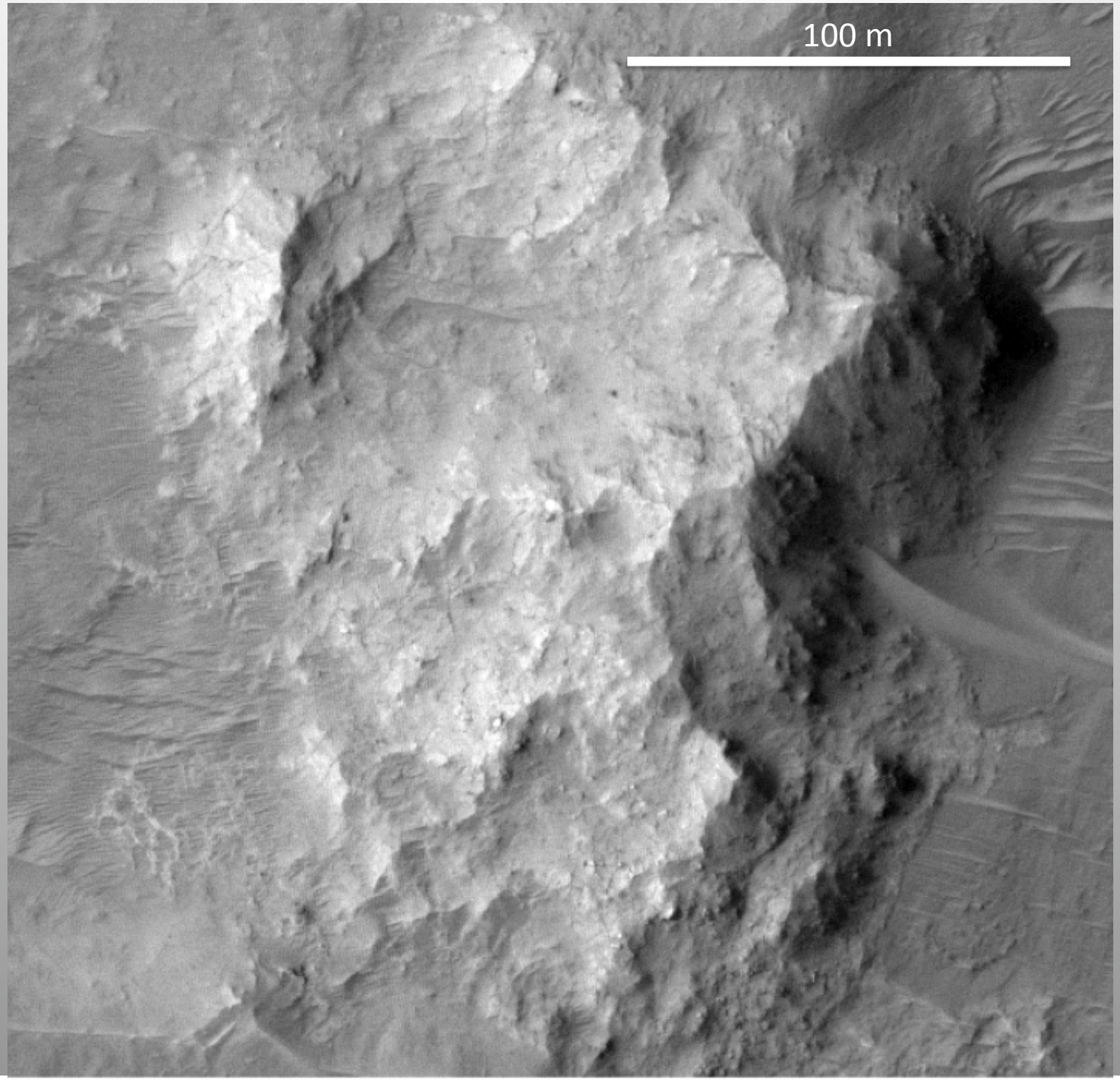
- Mesas of light-toned, layered and/or fractured materials on top of the pitted unit
- They appear to be the erosional remnants of a more extensive, basin-covering unit
- HYPOTHESIS: these may be lacustrine deposits



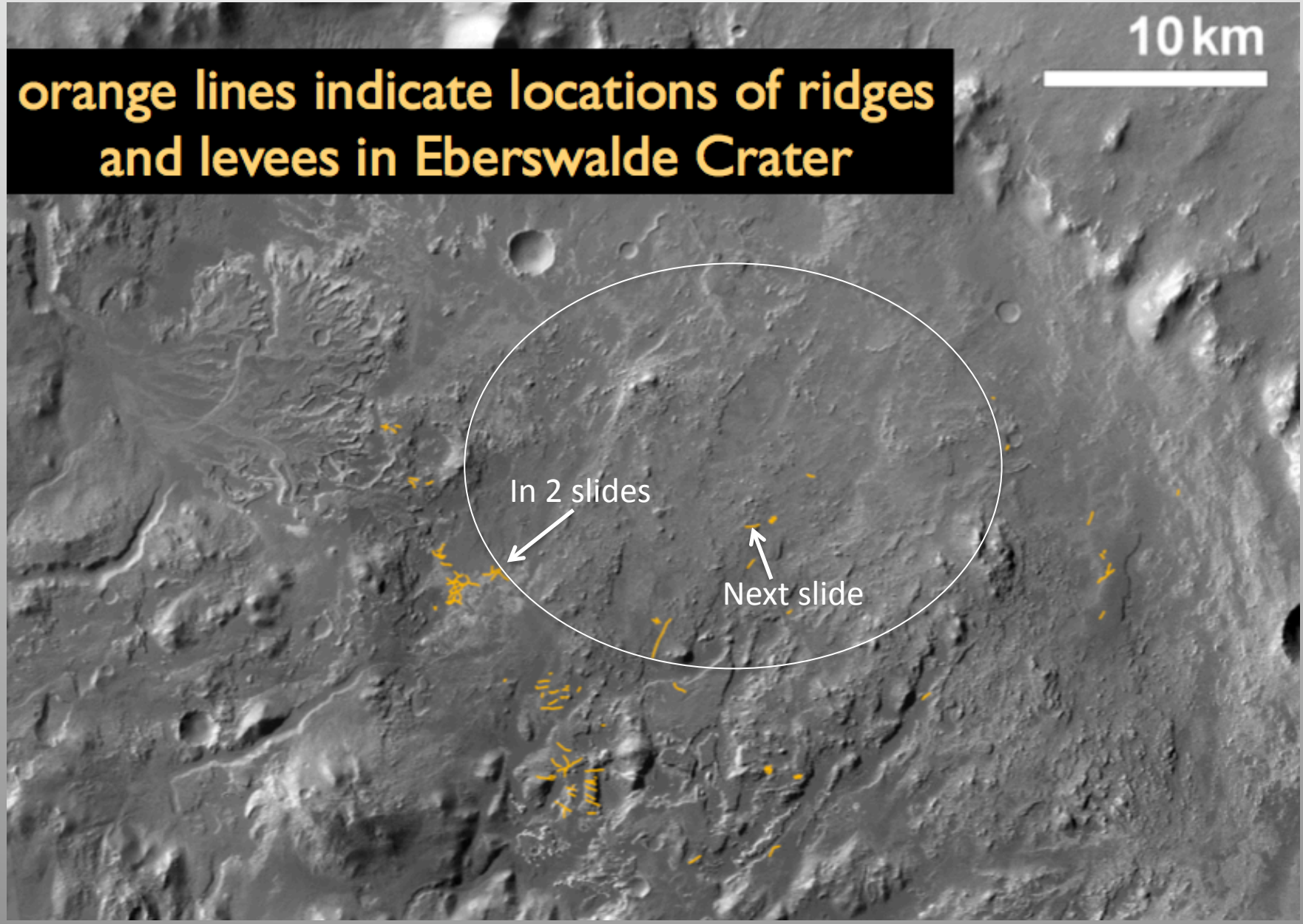
Locations where McKeown et al. (2011) identified phyllosilicate signatures in CRISM spectra

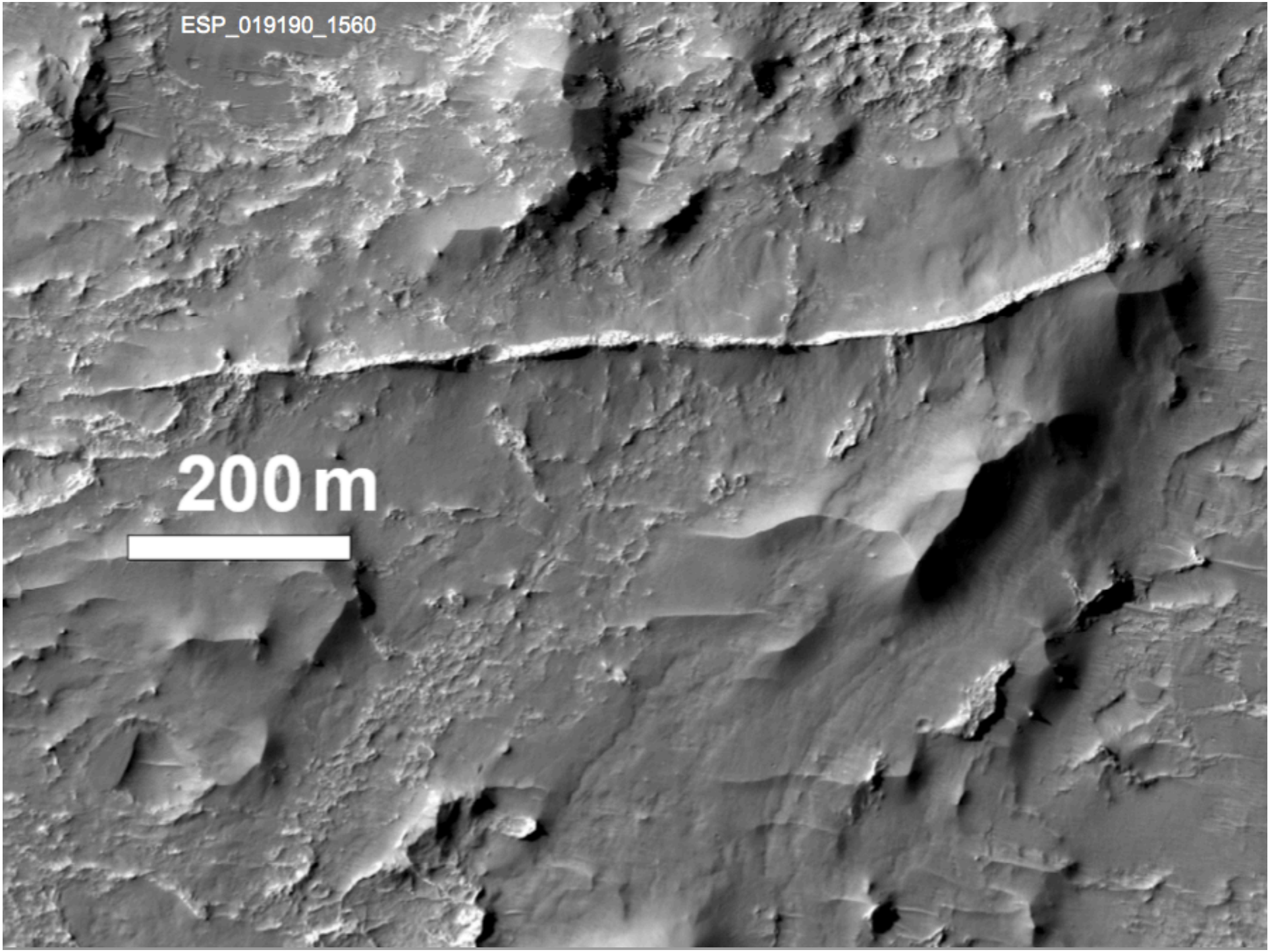
Isolated mounds of fractured material overlaying the pitted unit

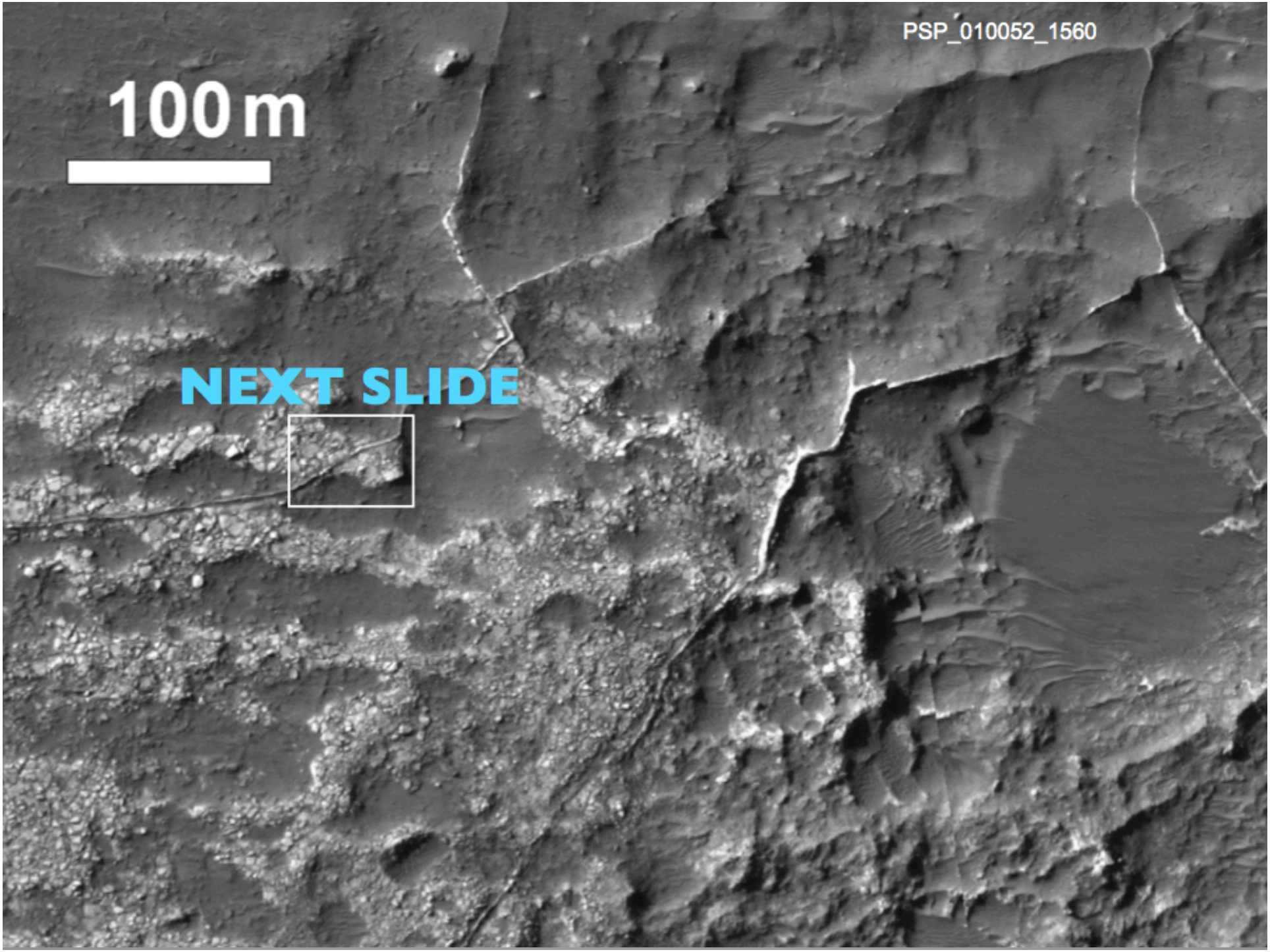


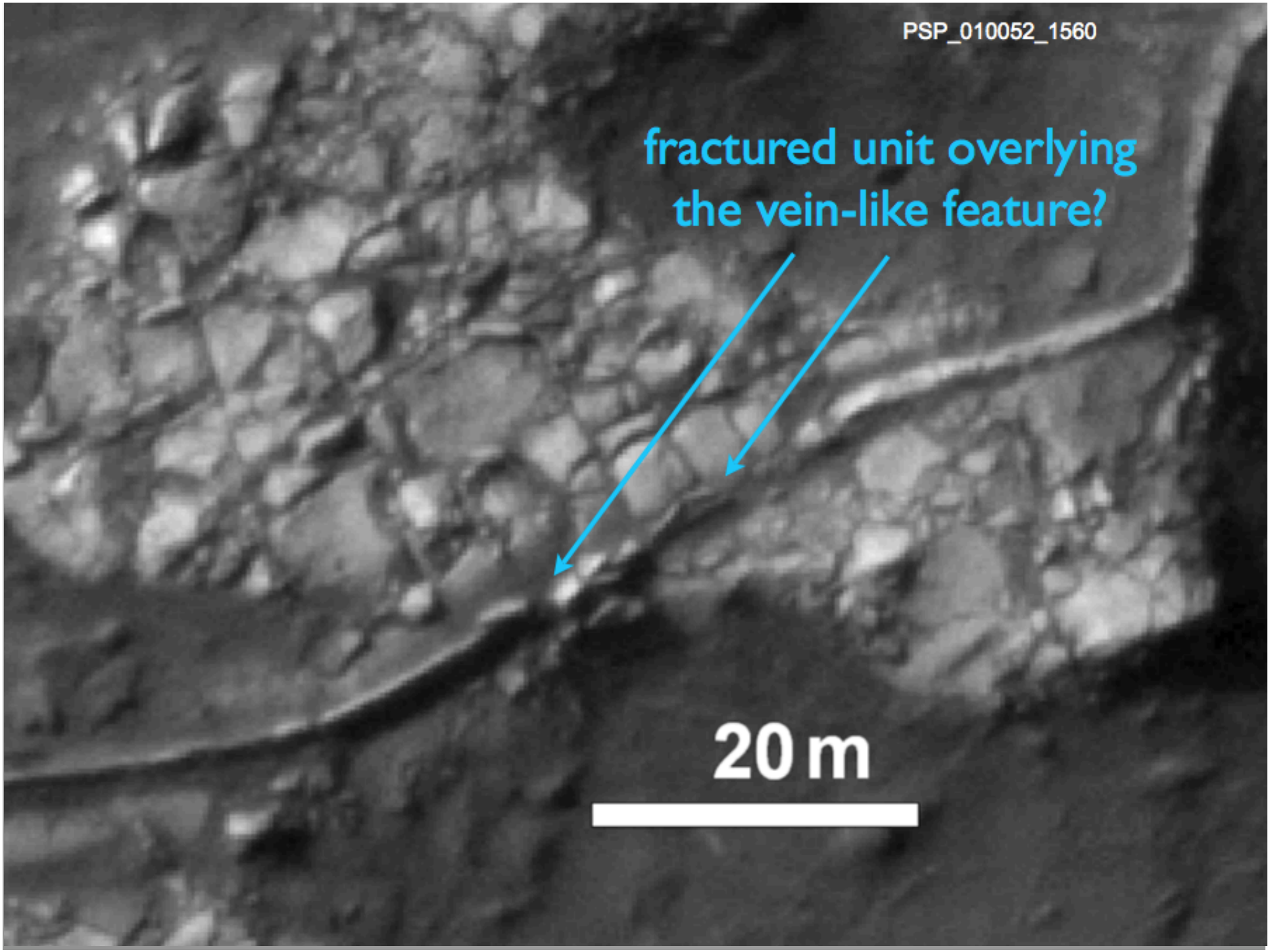

100 m

Vein-like Ridges




ESP_019190_1560
200 m


PSP_010052_1560
100 m
NEXT SLIDE


PSP_010052_1560
fractured unit overlying
the vein-like feature?
20 m

MOLA map stretched to show topographic variations within the Eberswalde basin

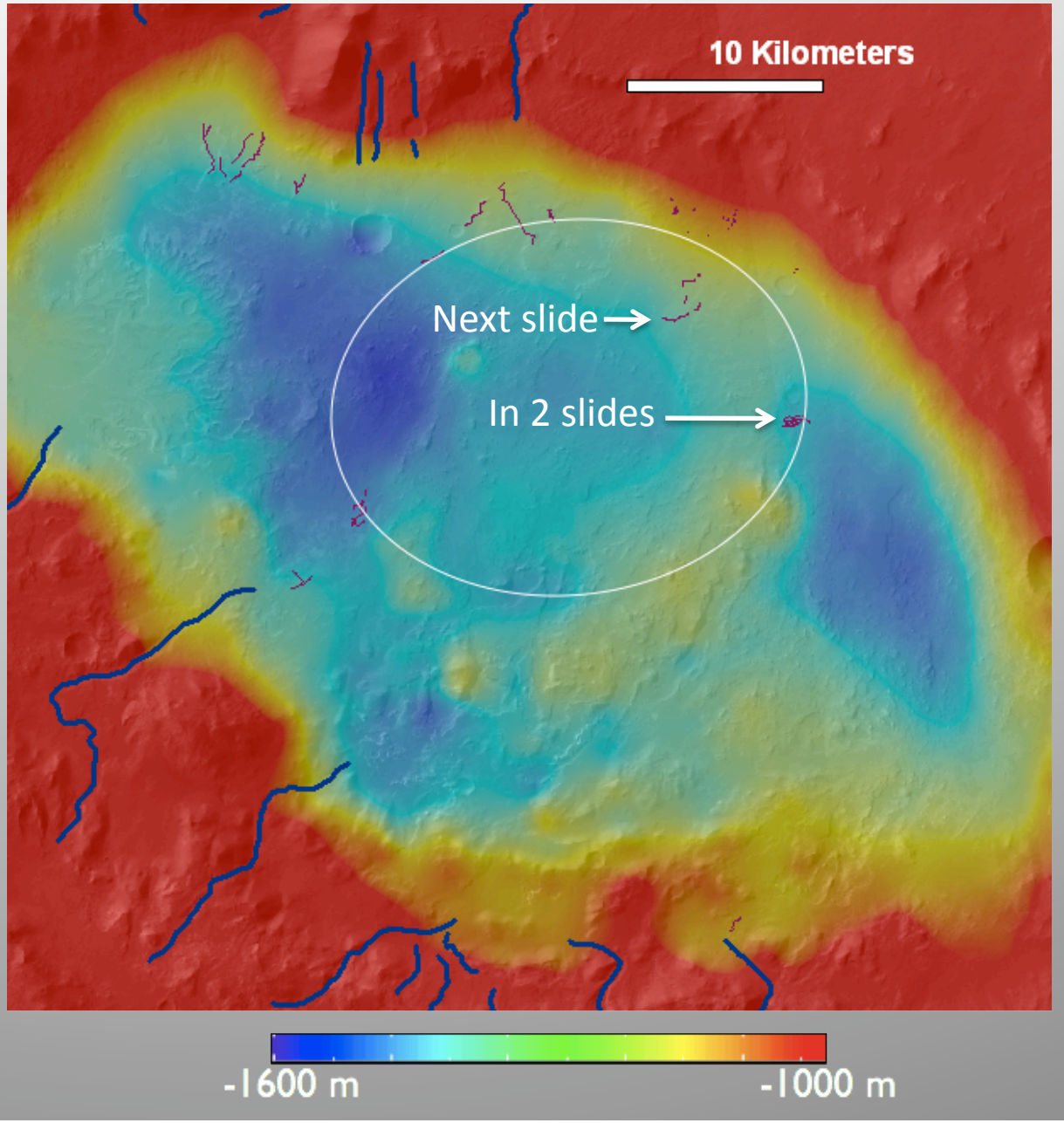
Thick blue lines are major drainage systems

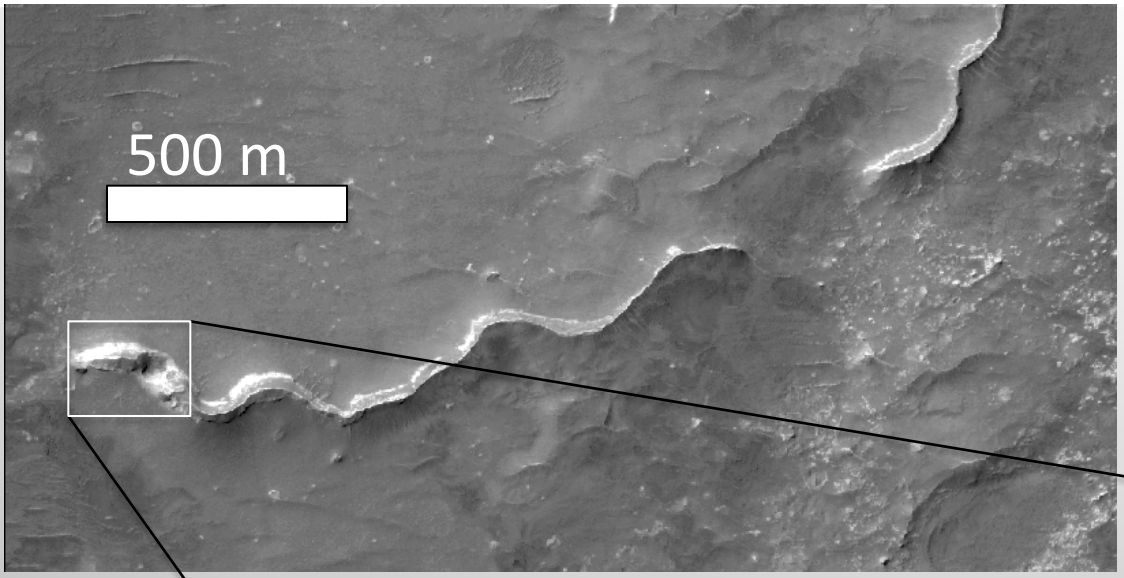
Thin purple lines are features interpreted as inverted channels (*Scheiber et al., 2008; Rice et al., 2010)*

Observations:
all channels but one lead from higher elevation crater rim to floor

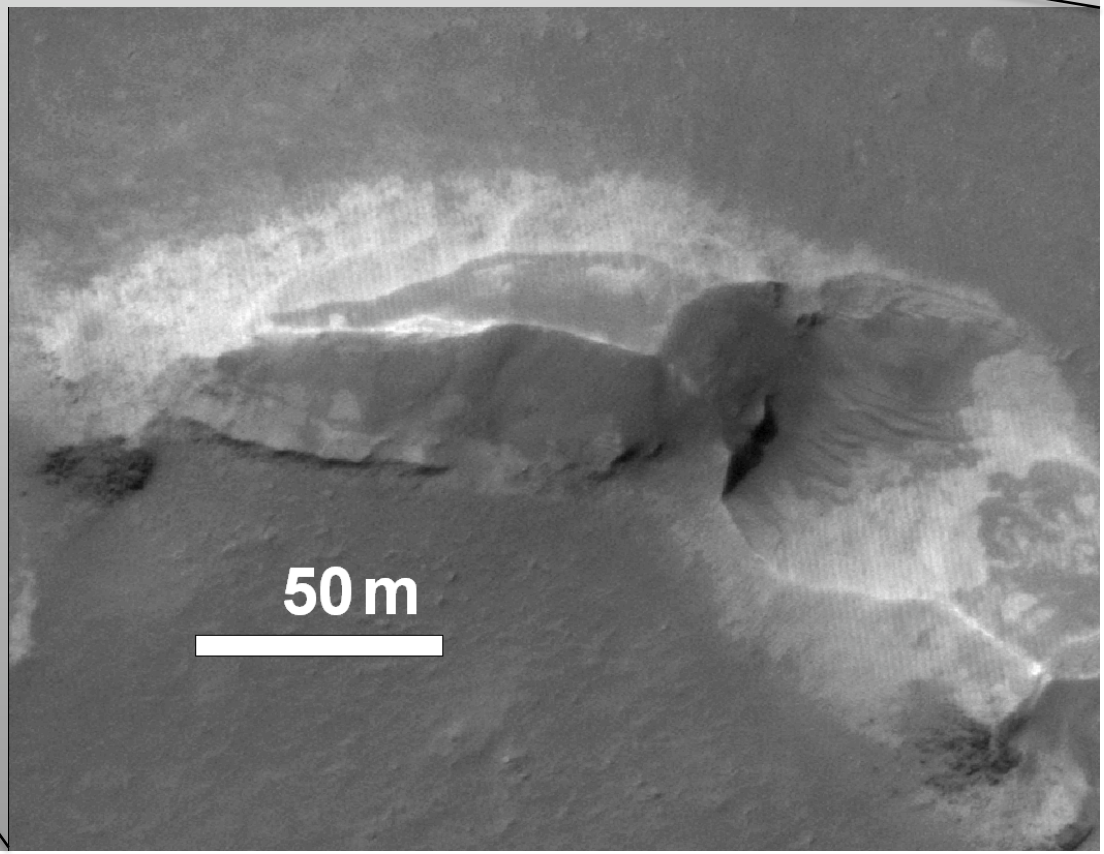
one channel (white box) leads from interior ridge to eastern floor

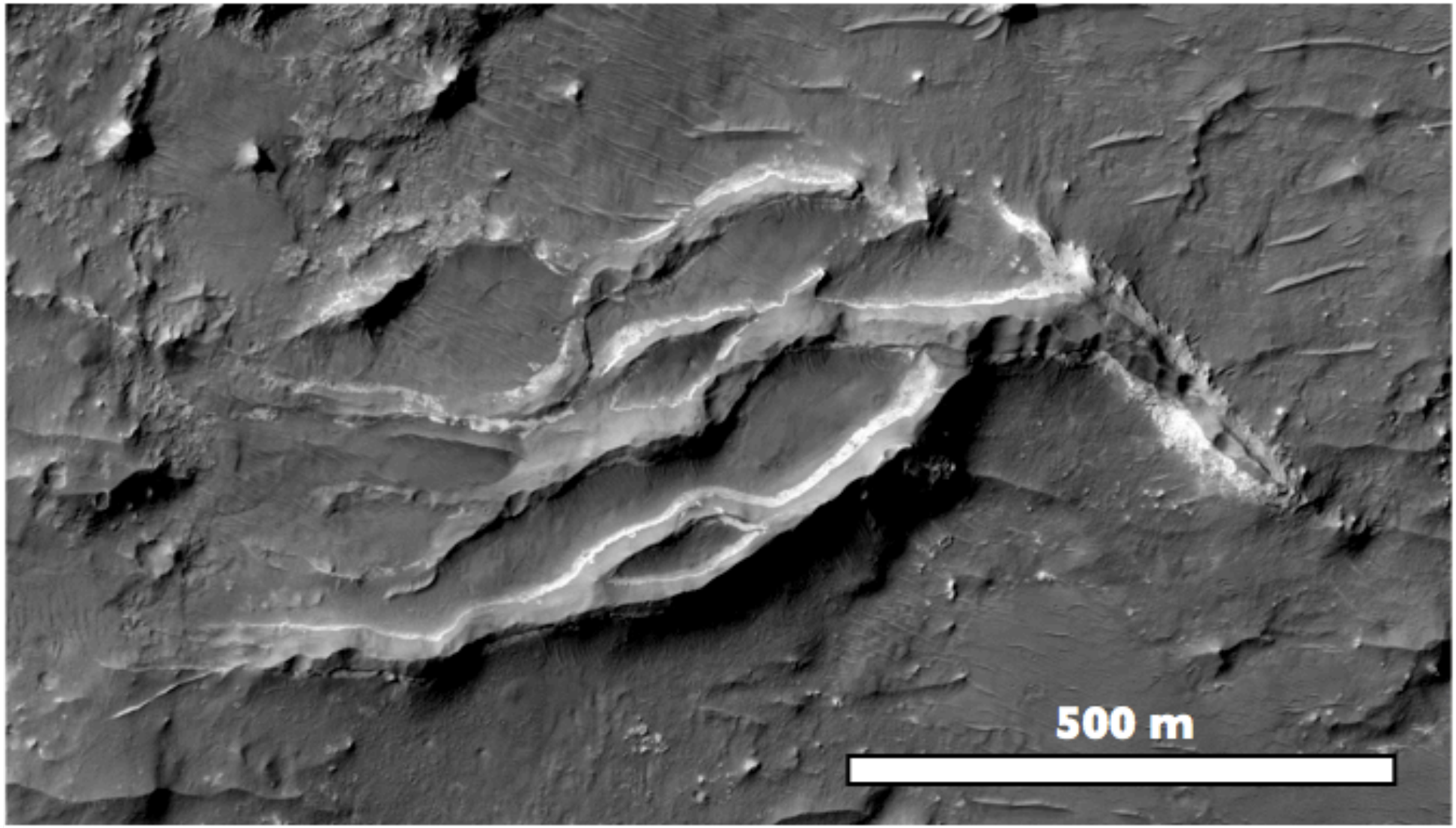
no other potential fluvial features yet observed in eastern Eberswalde crater





PSP_016065_1560




500 m

Conclusions Part I

- Our mapping of putative faults and their relationship to fluvio-deltaic stratigraphy suggests the following sequence of events:

1. Eberswalde Crater forms;
2. The pitted unit is deposited (potentially as eject from the Holden Crater impact), covering most of the crater floor;
3. Extensive faulting creates the Western Basin, Eastern Basin, and central high within the crater;
4. At least six fluvio-deltaic systems form, with the geomorphic pattern of delta development controlled by the fault-induced topography;
5. Crater fill material is excavated, leaving the inverted channels and deltas observed in present-day Eberswalde.

Conclusions Part II

- Morphologic diversity within the landing ellipse may include:
  - Faults
  - Ancient Eberswalde bedrock
  - Holden ejecta
  - Delta bottomsets
  - Deltaic layered sediments
  - Lacustrine deposits
  - Breccia dikes
  - Hydrothermal veins